A magnificent temple must have existed at Sardis, of which five entire columns remained in Dr. Chandler's time, but of which two only now exist, not less than six feet in diameter, and Lord Aberdeen thinks the building may be referred to the age of Tiberius.

As in Athens the best examples of the Doric style are to be found, so also we there discover in the Temple of Minerva-Polias, one of the best patterns (as it is one of the most commonly applied in modern times) of the Ionic order, erected too, probably about the time of the Parthenon. But one example, earlier in date, is highly interesting from the simplicity of its character, viz., the little temple on the Ilissus, to which writers have ascribed various names, some calling it a temple of Diana-the-Huntress (as Le Roy), some that it was consecrated to Panops (as Plato), whilst the greater part incline to the belief that it was connected with the Eleusinian mysteries, and dedicated either to the goddess Ceres, or to Triptolemus.

The Ionic is the first of the Greek orders in which we see introduced the base, thus distinguishing it from the Doric. But the most important feature of difference is in the capital, in which the volute is the conspicuous characteristic. The flutings, divided from each other by fillets, are better suited to the greater richness of the Ionic than would be the simple channels of the Doric.

The examples which are chiefly followed by modern architects are those of the temple on the Ilissus, and the Erectheum; the former, from its simplicity of detail and freedom from enrichment, is well adapted for situations where economy is studied; but many of the buildings executed in this country are imitated in their details from the triple Temple of Minerva-Polias, of which examples may be seen in the church of St. Pancras and the University Club-house, in Suffolk-street, whilst the General Post-office, in St. Martin's-le-grand, is designed after the style of the Temple of Minerva, at Priene. G. R. F.

CAUSE OF THE LATE ACCIDENT AT OLDHAM.

REPORT OF MESSRS. FAIRBURN AND BELLHOUSE.

REPORT:—

In consequence of an unanimous expression of feeling on the part of the coronor's jury, that a full and satisfactory inquiry should be made into the causes which led to the death of Joseph Tweedale and others, at Messrs. Radcliffe's cotton mill, Oldham, on Thursday last;—we, the undersigned, have carefully examined the building, and, having noted every particular relative to the walls, foundations, iron beams, columns, and their fractures, are of opinion that the accident has arisen from one of two causes; namely, from the falling of one of the arches in the first instance, or, what is more probable, from the breaking of one of the large beams supporting the transverse and longitudinal arches at the extreme gable of the mill.

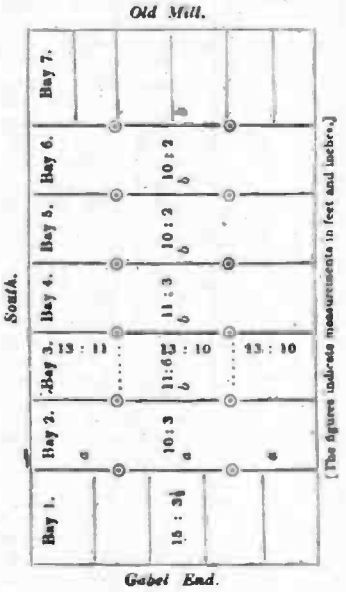
From the evidence already adduced, it appears that one of the arches in the top room (the fourth from the old mill) was observed to sink, some days previous to the accident which subsequently occurred; this arch, which had sunk about 4 inches, was considered unsafe, and the necessary preparations for refixing the centres were immediately taken for its renewal. During the rebuilding of the arch (of which about one-third was completed, the middle being removed, and the other remaining), the building at this critical period gave way; and, as stated by one of the witnesses, the beam broke short by the column, and the whole came down with a crash. Now in this view of the case (and assuming the evidence to be correct), it is obvious the beam must have broken from the lateral strain of the arches, and not from the weight acting vertically (as assumed) upon the beams which remained. In confirmation of this opinion, it will be observed that the middle beams were unprotected from the lateral thrust, unless we except an imperfect wooden stay, which, from its soft and fibrous nature, would easily split or crush by the force of the edge of a flange of only one inch thick pressing upon it.

Hence it follows that the thrust of two wide and flat arches would be quite sufficient to fracture the beam, and thus loosen or destroy the abutments on each side. The beam being ruptured, it is easy to conceive the result which must inevitably follow such an event. From the breakage of this beam, we may infer a serious and extensive accident; but to our minds, it does not sufficiently clear up the full amount of injury sustained; nor does it account for the immense crash and total destruction of the building which ultimately took place.

One of the middle beams, or any one single beam of the building giving way, could not, in our opinion, have made the ruins so complete; and having reason to suspect some other cause, we were induced to institute a still more minute and searching inquiry into the strengths and proportions of other parts of the structure.

On a careful examination of the fractured beams, and more particularly of those which stretch transversely across the building, at a distance of 15 feet from the extreme gabel of the mill, we found a more convincing proof of the cause which led to this unfortunate occurrence.

These beams carry the ends of four other beams, which extend longitudinally from the gabel on which they rest, as shewn in the following sketch:—



From the above, it will appear evident that the beams *a a a* had to support a much greater weight than the beams *b b b*, &c.; and consequently they required to be made of proportionately greater strength. They were made stronger; but unfortunately, from inadvertency, *or rather from want of knowledge*, they were strengthened in the wrong place; and instead of adding the additional strength to the bottom flange, which is always subjected to the greatest strain, it was given to the middle of the beam, where it was not required.

It is well known, or it ought to be known, to every person giving instructions for the form and construction of iron beams, that the strength is nearly a proportional of the section of the bottom rib or flange; and, according to Mr. Hodgkinson's experiments, a bottom flange of double the size will give nearly double the strength.

These facts having been proved by direct experiment, it is important to all those concerned in the construction of fire-proof buildings, in which the lives of the public and the property of individuals are at stake, that the form of beams and the section of greatest strength should be *perfectly and thoroughly understood*; and to those unacquainted with the subject, we would beg to refer them to Mr. Hodgkinson's paper on the strength of iron beams, in the fifth vol. second series, of the "Memoirs of the Literary and Philosophical Society of Manchester." In ordinary cases, we should not have troubled the jury with these remarks; but, in a case of such importance as the present, where the lives of so many persons have been sacrificed to defective knowledge and skill in the construction of buildings, wherein considerations of such importance are involved, we have considered it our duty thus publicly to direct attention to the subject, not only as regards the present but in all future cases, and respectfully to urge upon the proprietors of mills, and of other buildings containing workpeople, the necessity which exists for a more secure and perfect system of building, and for a further development of the principles upon which fire-proof edifices are founded. If this suggestion is properly received and acted upon, we have reason to believe, that we shall not again have occasion to investigate occurrences of so lamentable and so distressing a nature. We have already observed, that the beams *a a a*, in the preceding sketch were strengthened; not, however, in the bottom flange, but in the middle part of the beam, where they are thickened, and where it was absolutely of no use. Had the same quantity of metal been given to the lower flange, these beams (the weakest in the building*) would have carried nearly double the weight; and thus by a proper and judicious distribution of the metals, the building, as well as the lives of the people, would have been saved. These observations apply to all the other beams of the mill, which are also defective as respects their strength.

In computing the weights upon each beam, it was found that those supporting the arches of ten feet six inches, and those of eleven feet six inches span, had to support a load (without machinery) respectively of ten and eleven tons.

And those sustaining the ends of the longitudinal beams were acted upon with a load of 13¾ tons.

Now, if we take the sections of these beams, and calculate the weights necessary to break them, when laid upon the middle, it will be found that the breaking weights for the beams, *a a a*, and *b b b*, &c. will be nearly the same, or about 9¼ tons. This is the breaking weight of an average quality of iron; and, allowing for the difference of metals, it could not be raised much above 10 or 10½ tons.

The breaking weight would therefore be about 10 tons when the beam is loaded in the middle, and 20 tons when equally distributed over the whole surface of the projecting flange of the beam.

Having ascertained the bearing powers of the beams, we shall next compare their strength with the actual loads they were called upon to sustain; and, in making that comparison, it must be borne in mind that the two beams, *a a*, next the side wall, had their loads unequally distributed, which reduced their bearing powers to 15 tons.

Now, the load which these had to support was 13¾ tons, 8¼ tons being supported on a single point on one side, and 5½ tons distributed over the surface of the opposite flange on the other. From this it will be seen that the actual load was the breaking weight as the numbers 13·75 to 15, or as 1 to 1·09, being within a mere fraction, or one-tenth of absolute destruction.

Viewing the subject in this light, and taking the above calculations as data, we are no longer at a loss as to the cause of the accident. Even supposing the arches to have stood, it will appear obvious that so close an approximation of the breaking weight to the actual load was extremely unsafe; and that, under such circumstances, no precautions could have prevented the rupture of the transverse beams, *a a a*, whenever they happened to be subjected to the slightest impact, or any vibrating motion tending to disturb the parts under strain, and eventually, still further to lessen their already too much diminished powers of resistance.

Irrespective of the weakness of the iron beams, which we consider as the primary cause of the accident, we would beg to advert to the tie-rods, which, although sufficient in number and strength, were not judiciously placed as respects their position for resisting the strain of the arch, their maximum point of tension at the bottom flange of the beam; but, that being inconvenient, they should on no account be placed higher than the soffit of the arch; and in this position they would perforate the neutral axis, and give sufficient security to the arch without injuring the strength of the beam. Instead, however, of approaching this point, they were on the top of the beam, and 18 inches from the bottom flange.

As respects the arches, we found the vered

* Mr. Fairbairn added, that these beams were rather weaker in original construction than the transverse beams; and that the whole of them were certainly not such as would be considered safe.